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WORK PLAN

FOR WATERSHED PROTECTION AND FLOOD PREVENTION

BLACK CREEK-MASON WATERSHED

Mason County, Michigan



OUR SOIL ★ OUR STRENGTH

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WATERSHED WORK PLAN

BLACK CREEK WATERSHED

Mason County, Michigan

Prepared under the authority of the Watershed Protection and Flood Prevention Act (Public Law 566, 83rd Congress, 68 Stat. 666) as amended.

Prepared by:

Mason County Soil Conservation District
Black Creek Drainage District

With Assistance By:

U. S. Department of Agriculture, Soil Conservation Service
U. S. Department of Agriculture, Forest Service

June 1963

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THE WATERSHED WORK PLAN

Black Creek (Mason) Watershed

Mason County, Michigan
June 1963

SUMMARY OF PLAN

This watershed work plan for the Black Creek Watershed was prepared by the Mason County Soil Conservation District and the Black Creek Drainage District as sponsoring local organizations with assistance provided by the Soil Conservation Service and the Forest Service of the U. S. Department of Agriculture.

The watershed has an area of 10.5 square miles (6,678 acres) and is located in the west central part of the Lower Peninsula of Michigan.

The principal problems in the watershed are of frequent inundation and inadequate drainage outlets. Floods occur during the growing season, at the time of spring breakup, and in the fall.

There are an estimated 87 farms or parts of farms within the watershed. Owners of 49 of these farms are cooperators with the Mason County Soil Conservation District and of these, 30 have basic soil and water conservation farm plans. Average size farm is approximately 100 acres.

Land use in the joint floodwater and inadequate drainage area is distributed among cropland 79.5%; pasture 3.7%; woodlands 12.1%; and idle and miscellaneous 4.7%. This area, shown in Figure 1, includes portions of 21 farms. The cropland benefited from alleviation of floodwater damages and improved adequate drainage is 1,093 acres.

To provide the level of flood protection desired and to provide the needed drainage outlets, this work plan provides for the installation of 6.3 miles of multiple purpose channel improvements (flood prevention and agricultural water management (drainage)). This improvement along with the land treatment measures will provide flood protection such that flooding will not result up to a 10 year frequency storm.

Black River (Basin) (continued)

Black River, N.Y.
June 1907

WATERBURY

The Black River is a tributary of the Hudson River, and is one of the most important waterways of the State. It is a large river, and is one of the most important waterways of the State. It is a large river, and is one of the most important waterways of the State. It is a large river, and is one of the most important waterways of the State.

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The total project benefits are estimated at \$13,152 and include total flood prevention benefits of \$6,037 and agricultural water management (drainage) benefits of \$7,115.

The land treatment measures to be installed include all appropriate measures having hydrologic significance in reducing flooding frequency or that contribute to achieving the planned agricultural water management benefits. The measures are listed in Table 1.

The land treatment measures to be installed by individual landowners are estimated to cost \$49,155. Additional technical assistance to accelerate the planning and application of the land treatment measures will be provided from PL-566 funds at an estimated cost of \$8,310. These funds are in addition to the technical assistance costs to be provided by "going" programs estimated at \$4,250.

The structural measures included in the work plan are estimated to cost \$94,956 of which the PL-566 share is \$53,121 and the other than PL-566 share is \$41,835. The average annual operation and maintenance costs for the structural measures to be provided by the local sponsoring organizations is \$862.

The benefit cost ratio for the project is 2.9 to 1.0.

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DESCRIPTION OF THE WATERSHED

PHYSICAL DATA

The Black Creek Watershed is located in Mason County in the west central part of the Lower Peninsula of Michigan. It lies approximately 10 miles from Lake Michigan. The watershed, with a total area of 6,678 acres (10.5 square miles), is approximately 5.5 miles in length. The width varies from 2.5 - 1.5 miles.

Drainage

The Black Creek headwaters rise just north of the Village of Scottville and flow in a general easterly direction, then turn south around the village of Custer to its outlet into the Pere Marquette River. From this point, the Pere Marquette River flows in a westerly direction and outlets into Lake Michigan at the city of Ludington. The major tributaries of Black Creek are the Tuttle Drain, Falconer Drain, "W" Drain, and the Cassie Drain.

Topography

The upper two-thirds of the watershed has a relatively flat floodplain with slightly higher, gently undulating, land toward the designated watershed boundaries. This type of topography is conducive to flood damage and inadequate drainage. In the lower one-third of the watershed the stream is well entrenched with flooding confined to a relatively narrow ravine. The land on either side is rolling and well above the stream bottom.

Soils

The area is comprised of fine and moderately fine textured soils. There are some areas of sandy loam and loamy sands underlain by fine textured material. The majority of the area is composed of imperfectly drained soils with minor areas of well drained and poorly drained soils. Most of the soils are slowly to very slowly permeable. They are productive and in capability classes III and some IV. All of the locally common agricultural crops can be grown if adequately drained.

Climate

There are no U. S. Weather Bureau Stations in the watershed. The nearest temperature and precipitation recording station is located ten miles to the west in Ludington, Michigan. Due to the fact that Ludington is located on the shores of Lake Michigan, its weather is greatly influenced by the Lake. It appears that the station in Hart, Michigan, which is 20 miles to the south and approximately 8 miles inland from Lake Michigan, might more nearly parallel climate conditions of the watershed. The pertinent climatic data from these two stations are as follows:

SECTION 1. GENERAL

ARTICLE I

The first section of this article states that the power of the legislative branch shall be vested in the Congress of the United States, which shall consist of a Senate and House of Representatives. The second section provides that the House of Representatives shall be composed of Members chosen every second Year by the People of the several States, and the Electors in each State shall have the Qualifications requisite for Electors in that State.

ARTICLE II

The second article of the Constitution deals with the executive branch. It states that the executive Power shall be vested in a President of the United States, elected for a Term of four Years. The President shall hold Office from the first Term of January until the first Term of January following. He shall be Commander in Chief of the Army and Navy of the United States, and of the Militia of the several States, and he shall have the Power to grant Reprieves and Pardons for all Offenses against the United States, except in Cases of Impeachment.

ARTICLE III

The third article of the Constitution establishes the judicial branch. It states that the judicial Power shall be vested in one Supreme Court, and in such inferior Courts as the Congress may from time to time ordain and establish. The Judges, both of the Supreme and inferior Courts, shall hold their Offices during good Behaviour. They shall, at any Time during their Continuance in Office, be impeached and removed from Office by a two thirds Vote of both Houses of Congress.

ARTICLE IV

The fourth article of the Constitution deals with the states and federal government. It states that the United States shall guarantee to every State in this Union a Republican Form of Government. It also states that no State shall enter into any Treaty, Alliance, or Confederation with a Foreign State, nor shall State enter into any Agreement or Compact with another State, or with the United States, or with any foreign State, without the Consent of the Congress.

ARTICLE V

The fifth article of the Constitution provides for the amendment of the Constitution. It states that no State shall be deprived of equal Representation in the Senate without its Consent. It also states that no State, without its Consent, shall be deprived of its equal Suffrage in the House of Representatives. The article further states that no State shall be deprived of its equal Suffrage in the Senate without its Consent.

	<u>HART</u>	<u>LUDINGTON</u>
January Average Temperature	24.2° F	24.7° F
July Average Temperature	70.4° F	69.2° F
Maximum Temperature	104 ° F	97 ° F
Minimum Temperature	-24 ° F	-21 ° F
Last Killing Frost in Spring (ave.)	May 21	May 9
First Killing Frost in Fall (ave.)	September 30	October 23
Length of Growing Season (ave.)	132 days	167 days
Average Annual Precipitation	31.67 inches	29.21 inches

The average annual precipitation during the period of April through October represents approximately 65% of the yearly total with the greatest precipitation occurring in June.

Woodland

There are a total of about 656 acres of woodland and 150 acres in poor aspen and alder or brushy cover more suitably classified as game cover than productive woodland. About 500 acres has potential as woodland capable of producing a timber crop.

Timber types are primarily mixed hardwoods with maple, ash, elm, and other northern hardwood associated trees. Livestock have access to some of the woodlands. If these areas receive protection from grazing, then the growing stock can be carried to maturity and provisions for regeneration and stand improvement will successfully maintain the woodland.

Average volume per acre will be around 3 MBB/acre. A limited amount of cutting has occurred in the past and appears to have been primarily for local use.

Economic Data

The watershed is almost entirely rural. The village of Custer, population 275, is within the watershed boundaries. The village of Scottville, population 1,150, is located in the southwest portion of the watershed with watershed boundaries including a small portion of the village. Total population of watershed is estimated to be 725.

There are an estimated 87 farms or parts of farms within the watershed. Owners of 49 of these farms are cooperators with the Mason County Soil Conservation District and of these, 30 have basic soil and water conservation farm plans. Average size farm is approximately 100 acres.

The principal farming operations in the watershed are dairying and growing cashcrops. Principal crops grown are corn, snap beans, grains, hay and pasture. Approximately half of the corn is grown for silage. Snap bean production is increasing in the area due to favorable climatic conditions and the location of a processing plant at Scottville. These conditions tend to have a leveling effect on the economy of the area.

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U. S. Highway 10 crosses the lower part of the watershed in a west to east direction. U. S. Highway 31 crosses the watershed at its western boundaries. There is an irregular system of secondary roads in the watershed. Primarily, these roads are laid out on section lines but many of them are not continuous because of swampy areas or potholes.

The Chesapeake and Ohio Railroad crosses the watershed paralleling the route of U. S. Highway 10.

All of the lands in the watershed are privately owned. The present value of lands in the floodplain areas vary from \$50 (pot-holes) to \$175 (cropland).

Present land use in the bottomland area, upland area and for the entire watershed is estimated to be as follows:

<u>PRESENT LAND USE</u>	<u>BOTTOMLAND</u> (acres)	<u>UPLAND</u> (acres)	<u>TOTAL FOR</u> <u>WATERSHED</u> (acres)
Cropland	1,022	4,075	5,097
Pasture	48	240	288
Woods (including brush)	156	650	806
Idle and Misc.	<u>60</u>	<u>427</u>	<u>487</u>
TOTAL	1,286	5,392	6,678

WATERSHED PROBLEMS

Floodwater and Drainage Problems

Flood damage occurs a number of times each year during the growing season and in the fall. The spring breakup also causes flood damage and delayed planting.

The main stem of Black Creek and its major tributaries, through the reaches to be improved, are established county drains. These drains, as originally constructed, have inadequate capacity to handle flooding and provide drainage outlets.

Floods occur a number of times every year usually at the time of spring breakup, in the fall, and also in the growing season. Spring floods do not result in high direct damage to crops and pasture but they do bring about a delay in tillage operations resulting in crop yields that are depressed due to late planting. Flooding in the fall of the year hampers harvest operations resulting in considerable loss in yields. Minor floodwater damages occur to township roads and bridges.

Nearly all the lands shown on Figure I as area to be benefited by flood prevention and drainage, need some type of artificial

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1. The first step is to identify the problem.
 2. The second step is to define the problem.
 3. The third step is to analyze the problem.
 4. The fourth step is to develop a solution.
 5. The fifth step is to implement the solution.
 6. The sixth step is to evaluate the solution.
 7. The seventh step is to monitor the solution.
 8. The eighth step is to maintain the solution.
 9. The ninth step is to improve the solution.
 10. The tenth step is to document the solution.

drainage improvement for optimum agricultural use. The installation of these improvements is dependent on a substantial reduction of flooding and an improved drainage outlet on Black Creek.

Sediment and Erosion Damage

Erosion and sedimentation problems were considered and investigated during the process of work plan development. The investigations included field observations, interviews with farmers, and interviews with local technicians. On the basis of these studies, it was concluded that erosion and sedimentation damages were not of sufficient magnitude to warrant further detailed investigation.

PROJECTS OF OTHER AGENCIES

There are no known projects of other agencies that would affect or be affected by the works of improvement proposed in this work plan for installation in the Black Creek Watershed.

BASIS FOR PROJECT FORMULATION

The local sponsoring organizations outlined their project objectives prior to the initiation of detailed watershed surveys and investigations. The objectives included the development of an accelerated program of soil and water conservation in the watershed. This phase of the program was recognized as a necessary complement to the structural measures to be planned. It was a principal objective that a 10-year level of flood protection and adequate drainage outlets be provided on the Black Creek Main, Tuttle Drain, Falconer Drain and a new lateral located in Section 9 of the watershed. No interest was shown by the sponsors for improvement on the remaining tributaries.

The selection of structural measures was based on the needs for sufficient depth to provide adequate drainage outlets. The main stem has to be improved to provide the needed depth. It was determined that first consideration should be given to the possibility of floodwater retarding structures and that channel improvements to handle floodwater damage should be considered only as a supplemental measure necessary to the attainment of project objectives.

A study was made of the watershed for possible floodwater retardation sites. It was found that, due to topography, there were no available floodwater retardation sites that would provide any significant flood protection to the damage area. The impracticability of using floodwater retarding structures necessitated the consideration of multiple purpose channel improvements (flood prevention and agricultural water management (drainage)) as a solution to achieve project objectives.

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WORKS OF IMPROVEMENT TO BE INSTALLED

Land Treatment Program

In formulating plans for measures to be installed to achieve the desired project objectives, first consideration was given to the development of a land treatment program. Such a program was recognized as a basic and necessary complement to the needed structural measures.

The Mason County Soil Conservation District Board of Directors have made determinations as to the land treatment measures that watershed farmers would install during the period of project installation. These measures are primarily for watershed protection and agricultural water management (drainage).

The establishment of the contemplated land treatment program is essential to the functioning of the structural measures as planned. They are necessary to assure the functioning of the improved channel at operation and maintenance costs consistent with those shown in Table 4. The attainment of the project agricultural water management benefits will be dependent upon the application of the planned land treatment measures of a drainage type.

The land treatment measures proposed for installation are as follows: basic conservation farm plans, 22; district cooperators, 12; basic conservation farm plan revisions, 11; standard soil surveys, 3,000 acres; conservation cropping systems, 2,000 acres; plow planting, 200 acres; stripcropping field, 550 acres; grassed waterways, 10 acres; pasture renovation, 75 acres; pasture planting, 150 acres; cover cropping, 600 acres; crop residue use, 300 acres; wildlife habitat preservation, 200 acres; wildlife wetland preservation, 50 acres; wildlife food plantings, 10 acres; pond area plantings, 6 acres; field windbreaks, 1 acre; farm ponds, 6; tile drains, 55,000 feet; mains and laterals, 10,000 feet; ditch bank seeding, 10,000 feet; surface field ditches, 2,500 feet; drainage structures, 5; grade stabilization structures, 1; livestock exclusion, 25 acres; sustained yield management, 50 acres; timber stand improvement, 50 acres; tree planting (open field), 10 acres.

The land treatment measures will be installed by individual landowners. Some drainage land treatment measures will require the cooperation of small groups of farmers.

A number of tile systems will outlet into lateral (side) ditches off the main to insure a free outlet.

STRUCTURAL MEASURES

Multiple Purpose Channel Improvements

The main stem of Black Creek will be improved beginning near the center of Section 9 of the watershed and extending upstream

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3.7 miles. The lengths of tributary improvement, as measured from the confluence with the main, are as follows: Tuttle Drain 1.3 miles, Falconer Drain 0.8 mile, and the new lateral 0.5 mile. This gives a total of 6.3 miles of multiple purpose channel improvement which will provide adequate depth for drainage and contain the 10-year frequency flood within channel banks.

Information on channel size, capacity and other design characteristics can be found in Table 3.

Two channel stabilization structures were included in the plan because of the steep gradient of the channel to be improved. One structure is a 12' by 10' concrete drop box on the end of the corrugated metal pipe arch (span 11'7" and rise 7'7") under Filburn Road (Station 93+08) with a 2.5 foot overfall. This will be a full flow structure with a design capacity of 454 c.f.s. The other will be a standard channel drop structure constructed of reinforced concrete with a 5.0 foot overfall located on the new lateral in Section 9 of the watershed. Data for the weir section is as follows: 5.5 feet deep, 4.0 feet wide, 112 c.f.s. discharge through weir section. These drop structures are needed to reduce the amount of fall in the channel thus reducing the velocity sufficiently to reduce erosion of the improved channel.

The estimated installation cost for the channel improvement on the Black Creek Watershed is \$94,956. The estimated average annual operation and maintenance cost is \$862.

The installation costs and the sharing of those costs by PL-566 funds and other funds are shown in Table 2.

EXPLANATION OF INSTALLATION COSTS

The project installation costs are summarized in Table 1.

Land Treatment Measures

The installation costs shown in Columns 5 and 6 of Table 1, for individual land treatment measures, represents the estimated total cost to landowners in applying the quantities of the practices shown in Column 3. The costs shown include cost sharing assistance that landowners may receive from the Agricultural Conservation Program.

The technical assistance costs shown for the Soil Conservation Service in Column 6 represent the estimated costs to be borne by that agency in providing needed assistance to landowners in planning for and applying the land treatment program. The technical assistance cost shown for the Soil Conservation Service in Column 5 indicates the extent to which the total technical cost can be provided

The purpose of this report is to provide information on the results of the investigation conducted by the FBI in the case of the murder of Dr. Martin Luther King, Jr. on April 4, 1968, in Memphis, Tennessee. The investigation was conducted by the Memphis Police Department and the FBI, and the results are being reported to the Department of Justice.

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EXHIBIT A

The following is a list of the exhibits which were submitted to the Department of Justice for its review.

Exhibit A

The following is a list of the exhibits which were submitted to the Department of Justice for its review.

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by the present staff. Column 4 reflects the extent to which the land treatment program will require additional technical assistance costs from P.L. 566 funds. Likewise, the estimated costs of technical assistance for installing the forestry measures are shown in Columns 5 and 6. This assistance will be financed by the going Cooperative Forest Management Program

STRUCTURAL MEASURES

Multiple Purpose Channel Improvements

The total estimated installation costs for the multiple purpose channel improvements planned for the Black Creek Drain are shown in Column 12 of Table 2. Other columns in this table indicate the break-down of costs among construction, engineering and installation services, land easements and rights-of-way, and administration of contract. The installation of culvert of higher quality and greater performance capabilities at Tuttle, Filburn, and U. S. Highway 31 will be a local cost and included in land, easements and rights-of-way cost of project (\$15,450).

The construction costs have been determined by arriving at estimated types and quantities of construction items including clearing, excavation (earth), levelling of spoil, pipe drops to safely lower surface water into the improved channel, grading tributary channels back to a stable grade, grade control structures, seeding of ditch banks, berms and inside slopes of the spoil, and the removal of farm bridges which the local sponsoring organizations wish to abandon. The unit costs used to calculate the total estimated construction costs reflect the multiple judgement of local technicians, watershed planning party personnel, and the State Conservation Engineer as to costs that probably would be involved in awarding a contract for this type of construction in this area.

The land rights costs are based on a \$100 per acre cost for the lands necessary for the location of the channel improvements and the necessary work area for spoil spreading. This estimated cost for land was determined by the local sponsoring organizations to be a fair value for lands involved for channel construction.

Cost Allocation

The costs for the channel improvement have been allocated to the flood prevention and agricultural water management (drainage) purposes by use of the first alternate (paragraph 1132.211 of the Watershed Protection Handbook).

Joint cost allocation percentages were estimated to be flood prevention 45.9% and drainage 54.1%. Total costs allocated to each purpose were flood prevention \$43,585 and drainage \$51,371. Distribution of costs by purpose for flood prevention were PL-566 \$31,446 and other \$12,139; for drainage they were PL-566 \$21,675 and other \$29,696.

1. The first part of the report deals with the general situation in the country. It mentions the fact that the country is a developing one and that it has a long way to go in terms of economic development. It also mentions that the country has a rich natural resources and that it has a large population.

2. The second part of the report deals with the economic situation in the country. It mentions that the country has a high rate of inflation and that the economy is in a state of stagnation. It also mentions that the country has a large foreign debt and that it is struggling to pay it back.

3. The third part of the report deals with the social situation in the country. It mentions that the country has a high rate of unemployment and that the living standards are low. It also mentions that the country has a large population of people living in poverty and that there is a wide gap between the rich and the poor.

4. The fourth part of the report deals with the political situation in the country. It mentions that the country has a one-party system and that the government is authoritarian. It also mentions that there is a lot of corruption in the government and that the people are not allowed to express their opinions freely.

5. The fifth part of the report deals with the international situation in the country. It mentions that the country is a member of the United Nations and that it has good relations with most of the other countries in the world. It also mentions that the country is a member of the Organization of American States and that it has good relations with the other member states.

6. The sixth part of the report deals with the conclusion. It mentions that the country has a long way to go in terms of economic development and that it needs to implement reforms in order to improve its economic situation. It also mentions that the country needs to improve its social situation and that it needs to implement reforms in order to improve its political situation.

7. The seventh part of the report deals with the annexes. It mentions that there are several annexes to the report and that they contain additional information on the country's economy, social situation, and political situation. It also mentions that the annexes are available in both English and Spanish.

Basis for Determining Cost Sharing

Cost sharing of costs allocated to agricultural water management was based on the following watershed handbook criteria: Fifty percent of the construction cost and 100 percent of engineering services will be provided by PL-566 funds. The installation cost of the multiple purpose channel as a result of cost allocation and cost sharing was estimated to be PL-566 \$53,121 (55.9%); other \$41,835 (44.1%).

The installation of the project will be accomplished in a period of five years. An estimated schedule of Federal and non-Federal obligations by fiscal years is as follows:

<u>FISCAL YEARS</u>			
	<u>PL-566</u> (Dollars)	<u>Other</u> (Dollars)	<u>Total</u> (Dollars)
<u>First</u>			
Land Treatment	3,000	10,060	13,060
Black Creek Drain			
(L.E. & R/W (Black Creek Multiple Purpose Channel Improvement))	-----	23,600	23,600
Construction Contract	41,502	15,390	56,892
Installation Services	8,715	-----	8,715
Administration of Contract	-----	2,000	2,000
TOTAL	53,217	51,050	104,267
<u>Second</u>			
Land Treatment	2,000	8,200	10,200
Black Creek			
Installation Services	2,904	-----	2,904
Administration of Contract	-----	845	845
TOTAL	4,904	9,045	13,949
<u>Third</u>			
Land Treatment	1,104	8,200	9,304
TOTAL	1,104	8,200	9,304
<u>Fourth</u>			
Land Treatment	1,103	7,500	8,603
TOTAL	1,103	7,500	8,603
<u>Fifth</u>			
Land Treatment	1,103	6,885	7,988
TOTAL	1,103	6,885	7,988
GRAND TOTAL	61,431	82,680	144,111

Special Agent

Mr. J. Edgar Hoover
Director
Federal Bureau of Investigation
Washington, D. C.

Mr. Tolson
Mr. E. A. Tamm
Mr. Clegg
Mr. Glavin
Mr. Ladd
Mr. Nichols
Mr. Rosen
Mr. Tracy
Mr. Carson
Mr. Egan
Mr. Gurnea
Mr. Harbo
Mr. Hendon
Mr. Pennington
Mr. Quinn
Mr. Nease
Miss Gandy

Dear Sir:
Reference is made to your letter of the 10th instant, captioned as above.

Very truly yours,
J. Edgar Hoover

Enclosure

Very truly yours,
J. Edgar Hoover

cc - Mr. Tolson
cc - Mr. E. A. Tamm

cc - Mr. Clegg
cc - Mr. Glavin

cc - Mr. Ladd
cc - Mr. Nichols

cc - Mr. Rosen
cc - Mr. Tracy

cc - Mr. Carson
cc - Mr. Egan

cc - Mr. Gurnea
cc - Mr. Harbo

cc - Mr. Hendon
cc - Mr. Pennington

cc - Mr. Quinn
cc - Mr. Nease

cc - Miss Gandy

EFFECTS OF WORKS OF IMPROVEMENT

The installation of the proposed multiple purpose channel improvements will substantially reduce the flooding occurrence in the watershed problem area outlined in Figure 1. The installation of the 6.3 miles of channel improvement will change the flooding frequency from annually, and at times several floods in a single year, to an average of once in ten years. The road crossings which are presently subject to flooding will receive benefits due to the proposed works of improvement.

The proposed channel improvements will also provide adequate drainage outlets for the problem area. The two channel grade control structures will stabilize the channel bottom in the areas which presently have excess bottom slope for soil conditions.

The significant reduction in flooding frequency of the problem area along with the opportunity to obtain adequate drainage outlets will result in some land use changes and increased crop yields. The extent of anticipated changes are summarized under "Economic Investigations" in Section 2 of this work plan.

PROJECT BENEFITS

The total annual flood prevention benefits as a result of the project are estimated to be \$6,037 (Table 5). These benefits result from a more intensive use of existing cropland and changed land use such as the conversion of woodlands and pasture or idle lands to cropland.

The direct identifiable drainage benefits accruing as a result of the multiple purpose channel improvements are estimated to be \$7,115 annually. These benefits result primarily from an increase in yields due to improved drainage on existing cropland and from changes in land use from woodland, pasture or idle lands to cropland.

The land treatment measures proposed in Table 1, page 16, will not only reduce erosion damage but also reduce downstream sedimentation and channel maintenance.

Comparison of Benefits and Costs

The ratio of the estimated average annual benefits to costs for the multiple purpose channel improvement is 2.9 to 1. Only primary benefits have been used in the benefit cost analysis. Table 5 presents a comparison of benefits and costs for the structural works of improvement.

THE STATE OF THE WORLD

The world is a very different place than it was a few years ago. The population is increasing rapidly, and the demand for food and other necessities is growing. At the same time, the world is becoming more and more interconnected, and the flow of goods and services is increasing. This has led to a number of problems, including environmental degradation, social inequality, and political instability. It is important that we find ways to address these problems and create a more sustainable and just world for the future.

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PROJECT AREA

The project area is located in the state of the world. It is a very different place than it was a few years ago. The population is increasing rapidly, and the demand for food and other necessities is growing. At the same time, the world is becoming more and more interconnected, and the flow of goods and services is increasing. This has led to a number of problems, including environmental degradation, social inequality, and political instability. It is important that we find ways to address these problems and create a more sustainable and just world for the future.

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DESCRIPTION OF THE PROJECT

The project is a very different place than it was a few years ago. The population is increasing rapidly, and the demand for food and other necessities is growing. At the same time, the world is becoming more and more interconnected, and the flow of goods and services is increasing. This has led to a number of problems, including environmental degradation, social inequality, and political instability. It is important that we find ways to address these problems and create a more sustainable and just world for the future.

PROJECT INSTALLATION

Land Treatment Measures

The local landowners will carry out the land treatment program in cooperation with the Mason County Soil Conservation District within the watershed during the five year installation period and will encourage landowners and operators to maintain the land treatment measures for protection and improvement of the watershed.

The Soil Conservation Service will furnish sufficient technical assistance to the Mason County Soil Conservation District to carry out the accelerated program of land treatment. SCS technicians will assist landowners and cooperators of the Mason County Soil Conservation District in the preparation of soil and water conservation farm plans and in the application of soil and water conservation practices. The Public Law 566 funds needed for the acceleration of the land treatment program as shown in Table 1 were determined by calculating the extent to which added technical assistance would be needed from PL-566 funds.

Technical assistance for installing the forestry measures will be provided the landowners by the Michigan Department of Conservation, in cooperation with the U. S. Forest Service, under the going Cooperative Forest Management Program.

The Agricultural Conservation Program Service will assist farmers with the installation of the land treatment practices through the cost sharing provisions of that program.

Structural Measures

The Soil Conservation Service will disburse Federal funds and furnish technicians to complete field surveys necessary for final design plan purposes of works of improvement, preparation of specifications for bids, supervision of construction, and certification of payments.

The Black Creek Drainage District has the authority to levy assessments to raise local funds for cost sharing for construction of the structural measures, for administration of contracts, and for furnishing land rights (including the power of eminent domain) for the installation of the multiple purpose channel improvements. The Black Creek Drainage District will exercise this authority. The District can provide the lump sum amounts of money needed for construction purposes by issuance of negotiable drainage orders to be repaid from drainage assessments collectable in future years.

FINANCING PROJECT INSTALLATION

Land Treatment Measures

The land treatment measures will be installed by the landowners or farm operators under a program of voluntary cooperation with the Mason County Soil Conservation District.

Figure 1. The effect of the concentration of the *Agrobacterium* suspension on the transformation efficiency of *Agrobacterium* strains. The *Agrobacterium* strains were grown in YEA medium for 24 h at 28 °C. The cell concentration was adjusted to 10⁸ cells/ml. The cells were then mixed with the plant tissue and the transformation efficiency was determined. The results are shown as the mean ± SD of three independent experiments. The asterisk indicates a significant difference (p < 0.05) between the control and the treatment groups.

THE UNIVERSITY OF CHICAGO

1941-1942 1943-1944 1945-1946 1947-1948 1949-1950

The estimated cost for establishment of the land treatment measures during the five year project installation period is \$49,155 as shown in Table 1. This includes technical assistance costs to be borne by the Soil Conservation Service, going Cooperative Forest Management Program, and an expected reimbursement from the Agricultural Conservation Program.

The Soil Conservation Service will provide the Mason County Soil Conservation District with the technical assistance necessary for the installation of the land treatment program outlined in Table 1. This will require an estimated additional \$8,310 in technical assistance costs during the five year installation period over and above the assistance that can be provided by the present staff of the Work Unit serving the district. As shown in Table 1, it is expected that the staff presently available in the Work Unit will provide during the project installation period technical assistance costing about \$3,840. Cost sharing assistance for the installation of many of the measures may be available from the Agricultural Conservation Program Service.

The Michigan Department of Conservation, Forestry Division, in cooperation with the U. S. Forest Service will provide the technical assistance needed by woodland owners in carrying out and maintaining the planned land treatment measures on forest lands. The total technical assistance costs for the forestry phase of the land treatment program will be financed as follows: \$410 in funds to be made available by the State Forestry "going program" to provide the needed accelerated forestry program.

Structural Measures

The Black Creek Drainage District is a district legally organized under the Drainage Laws of the State of Michigan.

The Black Creek Drainage District plans to finance the local share of installation costs for improvements on the Black Creek Drain through a loan from the Farmers Home Administration. They have had some preliminary discussions on the matter with a representative of the Farmers Home Administration and expect to file a letter of intention at an early date.

Land, easements and rights-of-way will be obtained for a channel improvement before PL-566 funds are available for its construction. There is no indication at this time as to the extent to which the needed land rights will be obtained through donation. This will be determined only at the time of negotiating with the affected property owners for the necessary land rights.

It is understood that all financial and other assistance to be provided by the Soil Conservation Service and by PL-566 funds is contingent upon appropriation of funds for watershed program purposes.

Statement
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PROVISIONS FOR OPERATION AND MAINTENANCE

Land Treatment Measures

The land treatment measures will be installed, operated and maintained by the landowners or operators. This will be accomplished under district cooperator agreements with the Mason County Soil Conservation District. Assistance to landowners for the maintenance of the forest land treatment measures will be provided by the Michigan Department of Conservation, Forestry Division, in cooperation with the U. S. Forest Service through the Cooperative Forest Management Program.

Structural Measures

The multiple purpose channel improvements and grade stabilization measures will be operated and maintained by the Black Creek Drainage District. The average annual cost for this operation and maintenance has been estimated to be \$862. The Black Creek Drainage District will maintain and finance the maintenance of the channel improvement in the manner provided by the Michigan Drainage District Laws.

The following items will be provided for in the maintenance program:

1. A periodic inspection will be made of the structural works of improvement as needs arise but at least annually. The inspection will be made by a representative of the Drainage District.
2. A representative of the Soil Conservation Service will make inspections with the local organization, if possible, although separate inspections may be made.
3. All costs for labor, equipment, and materials for operation and maintenance, will be furnished by the appropriate local sponsoring organization.
4. Maintenance rights-of-way will be furnished to the structural measure by the Black Creek Drainage District.
5. A record will be maintained of all inspections, with one copy kept by the sponsoring local organization and another copy by the Soil Conservation Service.
6. Special inspections will follow severe or intense storms or incidents that may occur.
7. A specific maintenance agreement between the Soil Conservation Service and the Black Creek Drainage District will be executed prior to the issuance of invitations to bid on construction contracts.

1. Investigation

The investigation of the accident was conducted by the Safety Committee, which was composed of representatives of the various departments of the company. The investigation was held on the day following the accident, and the results were reported to the Board of Directors. The investigation found that the accident was caused by a combination of factors, including human error, equipment failure, and inadequate training. The Safety Committee recommended that the company should take steps to prevent such accidents from occurring in the future, including improving training, maintaining equipment, and implementing safety procedures.

2. Maintenance

The maintenance of the equipment was found to be satisfactory. The equipment was inspected regularly, and any defects were repaired promptly. The maintenance records showed that the equipment was in good condition at the time of the accident. The Safety Committee recommended that the company should continue to maintain its equipment in good condition, and that it should implement a more rigorous inspection program.

The investigation also found that the operator of the equipment was not properly trained. The operator had not received the necessary training to operate the equipment safely. The Safety Committee recommended that the company should provide adequate training for all operators of the equipment, and that it should implement a system to ensure that operators are properly trained before they are allowed to operate the equipment.

The investigation also found that the company's safety procedures were inadequate. The Safety Committee recommended that the company should develop and implement a comprehensive safety program, which would include safety procedures, training, and maintenance.

The investigation also found that the company's safety records were incomplete. The Safety Committee recommended that the company should maintain accurate and complete safety records, which would include records of accidents, inspections, and training.

The investigation also found that the company's safety culture was inadequate. The Safety Committee recommended that the company should develop a strong safety culture, which would be based on the principle that safety is the top priority.

The investigation also found that the company's safety committee was not effective. The Safety Committee recommended that the company should reorganize its safety committee, and that it should give the committee more authority.

The investigation also found that the company's safety training was inadequate. The Safety Committee recommended that the company should improve its safety training program, and that it should ensure that all operators are properly trained.

The investigation also found that the company's safety equipment was inadequate. The Safety Committee recommended that the company should invest in better safety equipment, and that it should ensure that all equipment is properly maintained.

The structural measures for grade stabilization will require timely maintenance to assure they function properly. All debris and undesirable vegetal growth at, or adjacent to, the stabilizing structures will be removed promptly. Scour damage due to local runoff or to high frequency storms will be repaired and stabilized by desirable vegetal growth.

The continued functioning of the multiple purpose channel improvements in providing the degree of flood protection for which it was designed and in serving as an adequate drainage outlet will require a timely maintenance program. This will require the control of undesirable vegetal growth by mowing and/or spraying, resloping of eroding banks, and the removal of debris and sediment bars. The proper location and installation of each drainage appurtenance will do much toward the maintenance of the improved channels.

It is expected that channel "cleanouts" will be needed every 10-15 years to keep the channel in proper operating condition. At such times, seedings will be renewed as necessary on the channel banks, berms, and inside slopes of the spoil.

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST
Black Creek (Mason) Watershed, Michigan

Installation Cost Item	Unit	No. Non Fed. Land	Estimated Cost (Dollars) <u>1/</u>		
			PL-566 Funds Non Fed Land	Other-Non Fed. Land	Total
(1)	(2)	(3)	(4)	(5)	(6)
Land Treatment					
<u>Soil Conservation Service</u>					
Basic Farm Conservation Plans	No.	22			
District Cooperators	No.	12			
Basic Farm Conservation Plans (Revised)	No.	11			
Standard Soil Surveys	Acres	3,000			
Conservation Cropping Systems	Acres	2,000			
Plow Planting	Acres	200			
Stripcropping, Field	Acres	550		2,200	2,200
Grassed Waterways	Acres	10		1,720	1,720
Pasture Renovation	Acres	75		1,875	1,875
Pasture Plantings	Acres	150		4,500	4,500
Cover Cropping	Acres	600		3,000	3,000
Crop Residue Use	Acres	300			
Wildlife Habitat Preservation	Acres	200			
Wildlife Wetland Preservation	Acres	50			
Wildlife Food Plantings	Acres	10		250	250
Pond Area Plantings	Acres	6		150	150
Field Windbreaks	Acres	1		25	25
Farm Ponds	No.	6		2,400	2,400
Tile Drains	Feet	55,000		13,750	13,750
Mains and Laterals	Feet	10,000		3,300	3,300
Ditch Bank Seeding	Feet	10,000		500	500
Surface Field Ditches	Feet	2,500		125	125
Drainage Structures	No.	5		1,250	1,250
Grade Stabilization Structure	No.	1		400	400
Technical Assistance			8,310	3,840	12,150
SCS Subtotal			8,310	39,285	47,595
<u>Forest Service</u>					
Livestock Exclusion	Acres	25		100	100
Sustained Yield Management	Acres	50		50	50
Timber Stand Improvement	Acres	50		600	600
Tree Planting (Open Field)	Acres	10		400	400
Technical Assistance				410	410
FS Subtotal				1,560	1,560
TOTAL LAND TREATMENT			8,310	40,845	49,155

TABLE 1 - ESTIMATED PROJECT INSTALLATION COST - Continued

Installation Cost Item	Unit	No. Non Fed.Land	Estimated Cost (Dollars) <u>1/</u>		
			PL-566 Funds Non Fed Land (4)	Other-Non Fed.Land (5)	Total (6)
(1)	(2)	(3)	(4)	(5)	(6)
<u>Structural Measures</u>					
<u>Soil Conservation Service</u>					
Multiple Purpose Channel Im- provement (Flood Prevention & Ag. Water Mgt. (drainage))	Miles	6.3	41,502	15,390	56,892
Subtotal Construction		6.3	41,502	15,390	56,892
<u>Installation Services</u>					
<u>Soil Conservation Service</u>					
Engineering Services			8,534		8,534
Other			3,085		3,085
Subtotal Installation Services			11,619		11,619
<u>Other Costs</u>					
Land, Easements & R/W				23,600	23,600
Administration of Contracts				2,845	2,845
Subtotal Other				26,445	26,445
TOTAL STRUCTURAL MEASURES			53,121	41,835	94,956
TOTAL PROJECT			61,431	82,680	144,111
<u>SUMMARY</u>					
Subtotal SCS			61,431	81,120	142,551
Subtotal FS				1,560	1,560
TOTAL PROJECT			61,431	82,680	144,111

Date June 1963

1/ Price Base 1962

1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator
(a)	(b)	(c)	(d)	(e)
1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator
1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator
1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator
1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator
1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator
1. Name of Farm	2. Address	3. County	4. State	5. Name of Operator

TABLE 1A - STATUS OF WATERSHED WORKS OF IMPROVEMENT
Black Creek (Mason) Watershed, Michigan

(at time of work plan preparation)

MEASURES (1)	UNIT (2)	APPLIED TO DATE (3)	TOTAL COST (Dollars) <u>1/</u> (4)
Land Treatment			
Basic Farm Conservation Plans	No.	30	-----
District Cooperators	No.	49	-----
Standard Soil Surveys	Acres	3,700	-----
Conservation Cropping Systems	Acres	1,091	-----
Stripcropping, Field	Acres	155	620
Grassed Waterways	Acres	4	688
Pasture Plantings	Acres	70	2,100
Pasture Renovation	Acres	47	1,175
Cover Cropping	Acres	195	975
Crop Residue Use	Acres	107	-----
Wildlife Habitat Preservation	Acres	33	-----
Tree Planting	Acres	7	280
Surface Field Ditches	Feet	3,150	158
Tile Drains	Feet	34,943	8,736
Mains and Laterals	Feet	8,940	2,950
Tile System Structure	No.	1	300
TOTAL	xxxxx	xxxxxx	17,982

Date June 1963

1/ Price Base 1962

TABLE 2 - ESTIMATED STRUCTURAL COST DISTRIBUTION

Black Creek (Mason) Watershed, Michigan

(Dollars) 1/

Structure (1)	Installation Cost-PL 566 Funds				Installation Cost - Other Funds						
	Con- struc- tion (2)	Install.Serv..		Total PL-566 (5)	Con- struc- tion (6)	Inst. Serv. (7)	Other			Total Other (11)	Total Inst. Cost (12)
		Engi- neer- ing (3)	Other (4)				Adm. of Cont. (8)	Ease- ments & R/W (9)	Water Rights (10)		
Multiple Purpose Channel Improvement Black Creek Drain	41,502	8,534	3,085	53,121	15,390	---	2,845	23,600	---	41,835	94,956
GRAND TOTAL	41,502	8,534	3,085	53,121	15,390	---	2,845	23,600	---	41,835	94,956

Date June 1963

1/ Price Base 1962

TABLE 3 - STRUCTURE DATA

CHANNELS

Black Creek (Mason) Watershed, Michigan

Channel Designation (Total Lineal Miles)	Sta.	Sta.	Distance Lineal Miles	Average Side Slope Ratio	Average Bottom Width (ft.)	Average Channel Depth (ft.)	Average Bottom Slope (ft./ft.)	Excavation Volume (Cu. Yds.)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Black Creek (3.70)	68	119	0.97	2:1	4.0	5.0	.0005	10,250
	119	173	1.02	2:1	4.0	5.0	.0005	11,022
	173	193	0.38	2:1	6.0	5.6	.0020	427
	193	205	0.23	2:1	6.0	6.0	.0020	679
	205	236	0.59	2:1	8.0	6.0	.0020	7,978
	236	250	0.26	2:1	8.0	6.0	.0020	5,211
	250	263	0.25	2:1	8.0	6.0	.0020	1,431
Falconer Drain (0.85)	504	515	0.21	2:1	4.0	5.0	.0040	1,153
	515	530	0.28	2:1	4.0	5.0	.0005	4,919
	530	549	0.36	2:1	4.0	5.0	.0025	6,337
Tuttle Drain (1.27)	310	363	1.00	2:1	4.0	5.0	.0005	3,386
	363	377	0.27	2:1	4.0	5.0	.0040	5,040
New Lateral (0.53)	410	438	0.53	2:1	4.0	5.0	.0040	10,390

TABLE 3 - STRUCTURE DATA Cont'd.

CHANNELS

Black Creek (Mason) Watershed, Michigan

Channel Designation (Total Linear Miles)	Sta.	Sta.	Watershed Area (sq. mi.)	Hydraulic Radius (ft.)	Value of "n"	Hydraulic Grade Slope (ft./ft.)	Channel Velocity (ft./sec.)	Channel Area (sq.ft.)	Estimated Channel Capacity c.f.s.	Required Capacity c.f.s.
(1)	(2)	(3)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
Black Creek (3.70)	68	119	0.40	2.66	.035	.0005	1.83	70.0	128	43
	119	173	0.84	2.66	.035	.0005	1.83	70.0	128	94
	173	193	3.89	3.10	.035	.0020	4.03	96.3	388	385
	193	205	4.93	3.29	.035	.0020	4.20	108.0	454	455
	205	236	5.38	3.45	.035	.0020	4.33	120.0	520	482
	236	250	6.02	3.45	.035	.0020	4.33	120.0	520	540
	250	263	6.26	3.45	.035	.0020	4.33	120.0	520	540
1/ Falconer Drain (0.85)	504	515	0.13	0.98	.040	.0040	2.30	10.5	24	23
	515	530	0.28	1.72	.040	.0005	1.19	30.0	36	35
	530	549	0.42	1.43	.040	.0025	2.32	21.1	48	45
1/ Tuttle Drain (1.27)	310	363	0.50	2.19	.040	.0005	1.40	48.0	66	60
	363	377	0.99	1.82	.040	.0040	3.51	33.3	117	115
1/ New Lateral (0.53)	410	438	0.49	1.72	.040	.0040	2.98	21.1	63	60

1/ Values shown for these drains represent approximate Q_{10} flow, less than bank full.

The following table shows the results of the experiments conducted on the 15th of June 1881. The experiments were conducted in the presence of the Hon. Mr. Justice G. B. Bowen, and the Hon. Mr. Justice G. B. Bowen, and the Hon. Mr. Justice G. B. Bowen.

Time	Temperature	Humidity	Wind	Direction	Force	Clouds	Light	Sound	Other
10.00	72.0	75.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
11.00	73.0	76.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
12.00	74.0	77.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
13.00	75.0	78.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
14.00	76.0	79.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
15.00	77.0	80.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
16.00	78.0	81.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
17.00	79.0	82.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
18.00	80.0	83.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
19.00	81.0	84.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
20.00	82.0	85.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
21.00	83.0	86.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
22.00	84.0	87.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
23.00	85.0	88.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
24.00	86.0	89.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
25.00	87.0	90.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
26.00	88.0	91.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
27.00	89.0	92.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
28.00	90.0	93.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
29.00	91.0	94.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
30.00	92.0	95.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
31.00	93.0	96.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
32.00	94.0	97.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
33.00	95.0	98.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
34.00	96.0	99.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
35.00	97.0	100.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
36.00	98.0	101.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
37.00	99.0	102.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
38.00	100.0	103.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
39.00	101.0	104.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
40.00	102.0	105.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
41.00	103.0	106.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
42.00	104.0	107.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
43.00	105.0	108.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
44.00	106.0	109.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
45.00	107.0	110.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
46.00	108.0	111.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
47.00	109.0	112.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
48.00	110.0	113.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
49.00	111.0	114.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
50.00	112.0	115.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
51.00	113.0	116.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
52.00	114.0	117.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
53.00	115.0	118.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
54.00	116.0	119.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
55.00	117.0	120.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
56.00	118.0	121.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
57.00	119.0	122.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
58.00	120.0	123.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
59.00	121.0	124.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
60.00	122.0	125.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
61.00	123.0	126.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
62.00	124.0	127.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
63.00	125.0	128.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
64.00	126.0	129.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
65.00	127.0	130.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
66.00	128.0	131.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
67.00	129.0	132.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
68.00	130.0	133.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
69.00	131.0	134.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
70.00	132.0	135.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
71.00	133.0	136.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
72.00	134.0	137.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
73.00	135.0	138.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
74.00	136.0	139.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
75.00	137.0	140.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
76.00	138.0	141.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
77.00	139.0	142.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
78.00	140.0	143.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
79.00	141.0	144.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
80.00	142.0	145.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
81.00	143.0	146.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
82.00	144.0	147.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
83.00	145.0	148.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
84.00	146.0	149.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
85.00	147.0	150.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
86.00	148.0	151.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
87.00	149.0	152.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
88.00	150.0	153.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
89.00	151.0	154.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
90.00	152.0	155.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
91.00	153.0	156.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
92.00	154.0	157.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
93.00	155.0	158.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
94.00	156.0	159.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
95.00	157.0	160.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
96.00	158.0	161.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
97.00	159.0	162.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
98.00	160.0	163.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
99.00	161.0	164.0	1.0	SW	1.0	0.0	0.0	0.0	0.0
100.00	162.0	165.0	1.0	SW	1.0	0.0	0.0	0.0	0.0

TABLE 4 - ANNUAL COST

Black Creek (Mason) Watershed, Michigan

(Dollars) 1/

Evaluation Unit (1)	Amortization of Installation Cost <u>2/</u> (2)	Operation and Maintenance Cost (3)	Other Economic Cost (4)	Total (5)
Black Creek Drain	3,691	862		4,553
TOTAL	3,691	862		4,553

Date June 1963

1/ Price Base 1962 for installation costs.
1961 - projected long term for benefits, operation & maintenance, and other economic costs.

2/ 3% - 50 year amortization period.

2. $\alpha = 0.05$ (one-tailed test)

3. $\alpha = 0.05$ (two-tailed test)

4. $\alpha = 0.05$ (one-tailed test) $\alpha = 0.05$ (two-tailed test)

Test Statistic	Decision Rule	Conclusion	Power
$t = 1.5$	Reject H_0 if $t > 1.645$	Do not reject H_0	0.05
$t = 1.5$	Reject H_0 if $ t > 1.96$	Do not reject H_0	0.05
$t = 1.5$	Reject H_0 if $t > 1.645$ or $t < -1.645$	Do not reject H_0	0.05

Conclusion

The results of the hypothesis tests are as follows:

1. $\alpha = 0.05$ (one-tailed test)

TABLE 5 - COMPARISON OF BENEFITS AND COSTS FOR STRUCTURAL MEASURES

Black Creek (Mason) Watershed, Michigan

(Dollars) L/

Evaluation Unit	AVERAGE ANNUAL BENEFITS				Average Annual Cost (5)	Benefit Cost Ratio (6)
	Flood Prevention	Agr. Water Mgt.	Drainage (3)	Total (4)		
	More Intensive Land Use and Changed Land Use (2)					
(1)						
Black Creek Drain	6,037		7,115	13,152	4,553	2.9:1.0
GRAND TOTAL	6,037		7,115	13,152	4,553	2.9:1.0

Date June 1963

L/ Price Base 1962 - Installation Cost
1961 projected long term for benefits, operation and maintenance and other economic costs.

REPORT OF THE COMMISSIONER OF THE GENERAL LAND OFFICE

1890-1891

Name of the land	Area in acres	Value in pounds	Description of the land		Remarks
			Number of acres	Value in pounds	
1. The land of the Crown	100	100	100	100	
2. The land of the Duke of Devonshire	200	200	200	200	
3. The land of the Earl of Devon	300	300	300	300	
4. The land of the Duke of Somerset	400	400	400	400	
5. The land of the Duke of Northumberland	500	500	500	500	
6. The land of the Duke of Newcastle	600	600	600	600	
7. The land of the Duke of Argyll	700	700	700	700	
8. The land of the Duke of Devon	800	800	800	800	
9. The land of the Duke of Devonshire	900	900	900	900	
10. The land of the Duke of Devon	1000	1000	1000	1000	

INVESTIGATIONS AND ANALYSIS

Hydrologic and Hydraulic Studies

There are no rainfall or stream gaging stations located within the Black Creek Watershed. The rainfall amounts were determined from U. S. Weather Bureau Technical Paper # 40.

A total of ten valley cross sections were taken in the floodplain. Seven on Black Creek and one each on Tuttle, Falconer, and New Drains which are tributaries of Black Creek. These were taken to establish the relationship between discharge (stage) and area flooded for the 50 year, 25 year, 10 year, 5 year, 2 year and 1.1 year frequencies. At each valley section a field survey was made to determine the cross-sectional area within banks and for overbank conditions. A field survey was made to develop the channel profile for Black Creek and the tributaries to be improved. This included 3.7 miles on Black Creek, 1.3 miles on Tuttle Drain, 0.8 mile on Falconer Drain, and 0.5 mile on the new lateral. All survey information was referred to the U.S.G.S. mean sea level datum. Roughness coefficients "n" were determined from field observations for within bank and overbank conditions. Rating curves, which established the relationship between discharge and stage, were based upon information developed using Manning's Formula. Stage-frequency data developed in the hydrologic analyses were used to delineate the areas of floodwater damage.

Discharge amounts for the selected frequencies were determined by flood routing in several damage reaches. In this analysis the discharges were based on converting rainfall to runoff. The rainfall amounts for selected frequencies were obtained from the U. S. Weather Bureau Technical Paper # 40. The without project and with project hydrologic soil-cover complex numbers for the watershed are 82 and 83, respectively. These factors were used to convert rainfall to runoff.

Hydrographs (using a six-hour storm duration) were developed for the sub-areas in the watershed for three runoff amounts. The sub-area hydrographs were combined and flood routed using the Wilson Graphical Method to obtain discharges at the necessary locations within the watershed. The routing was carried downstream beyond the reaches to be improved. This showed Black Creek to have an adequate outlet.

Design discharges for the improved channel will be usable in the operations design. The design discharges were determined by flood routing the 10-year frequency design flood through the watershed by the Wilson Graphical Method.

Studies were made of the available U.S.G.S. stream flow records in the area to determine the relation of the "all year" to the "growing season" occurrence of floods. This study indicated that a discharge-frequency line, based upon "growing season" events only, was lower than the discharges for the same frequencies based upon largest annual events. Factors were developed for the selected frequencies and the discharges and acres flooded at each valley section were modified to reflect the "growing season" occurrence of floods.

Summary of the Report

The first part of the report deals with the general situation of the country at the end of the war. It describes the state of the economy, the social conditions, and the political situation. The second part of the report is devoted to a detailed analysis of the economic situation. It discusses the various sectors of the economy, such as agriculture, industry, and commerce, and the impact of the war on each of them. The third part of the report is a summary of the findings of the study. It concludes that the country has suffered a severe economic crisis as a result of the war, and that the government must take immediate steps to restore the economy and improve the living conditions of the population.

The fourth part of the report is a list of recommendations. It suggests that the government should implement a series of measures to stimulate economic growth, including the reduction of taxes, the improvement of the legal system, and the development of infrastructure. It also recommends that the government should take steps to improve the social conditions of the population, such as the provision of housing, education, and healthcare.

The fifth part of the report is a conclusion. It states that the study has shown that the country is in a state of economic crisis, and that the government must take immediate action to address the problem. It also states that the study has identified a number of factors that are contributing to the crisis, and that the government should focus on these factors in its efforts to restore the economy.

The sixth part of the report is a list of references. It includes a list of books, articles, and other sources that were used in the study.

The seventh part of the report is a list of appendices. It includes a list of tables, figures, and other material that are included in the report. The eighth part of the report is a list of indices. It includes a list of names, places, and other subjects that are indexed in the report.

Design Investigations

A baseline survey was made of Black Creek and the proposed new lateral located in section 9 of the watershed. Cross sections were taken approximately 10 per mile to determine excavation quantities. A chain survey was made on the Tuttle and Falconer Drains which enter the Black Creek in section 8 of the watershed. Cross sections on the Tuttle and Falconer Drains were taken approximately five per mile to determine excavation quantities. Sixteen soil borings were taken along the 6.3 miles of channel to be improved and used to determine allowable velocity and side slopes. Through field inspection, it was determined that there were no adequate floodwater retarding sites so any flood reduction would be accomplished by channel improvement.

Channel improvement will commence on Black Creek near the center of section 9 (sta. 263+00) and extend 3.7 miles upstream (sta. 68+00). The side drains to be improved are as follows: Tuttle Drain 1.3 miles, Falconer Drain 0.8 mile, and the new lateral 0.5 mile.

Flood control design for Black Creek was based on peak discharges and runoff to be expected during the growing season on the average of once in ten years.

Channel capacity was determined using Mannings' formula. Recommended values for "n", velocity, and side slopes as given in the National Engineering Handbook, Section 16 were used in design.

A study was made on the lower reach of Black Creek which will not be improved to determine if it will provide an adequate outlet. This reach, from the Black Creek confluence with the Pere Marquette River upstream to station 263+00, is approximately 3.0 miles in length. The stream is well entrenched with an average bottom slope of .003 foot per foot. It was determined that the present channel has sufficient capacity to carry the increased discharges without damage through this reach.

County road bridges and culverts affected by the project were investigated to determine capability to carry design flow. The culvert at Tuttle Road (station 230+79) was found to be small and will be replaced with a larger CMP arch. The bridge at Filburn Road (station 193+08) is in a poor state of repair and could not be feasibly underpinned; therefore, it will be replaced with a CMP arch with a drop box for grade control. At station 90+00 a new larger CMP under U. S. Highway 31 will be installed. All other bridges and culverts affected will carry the design flow without alteration.

Aerial photographs, field inspection, and engineering surveys were used to determine units of clearing and side drainage structures. Typical channel cross sections with placement of spoil were used to determine channel right-of-way and seeding acreage.

Economic Investigations

In determining the benefits of the proposed project, an inventory was made of the land use of all the lands in the problem area. The future land use of the watershed was determined to be as follows:

<u>PRESENT LAND USE</u>	<u>BOTTOMLAND</u> (acres)	<u>UPLAND</u> (acres)	<u>TOTAL FOR</u> <u>WATERSHED</u> (acres)
Cropland	1,022	4,075	5,097
Pasture	48	240	288
Woods (including brush)	156	650	806
Idle and Misc.	60	427	487
TOTAL	1,286	5,392	6,678

<u>FUTURE LAND USE</u>	<u>BOTTOMLAND</u> (acres)	<u>UPLAND</u> (acres)	<u>TOTAL FOR</u> <u>WATERSHED</u> (acres)
Cropland	1,093	4,075	5,168
Pasture	24	240	264
Woods (including brush)	109	650	759
Idle and Misc.	60	427	487
TOTAL	1,286	5,392	6,678

Schedules were obtained from interviews by random sampling with the owners and operators of approximately 80% of the lands in the area of floodwater damage and impaired drainage. These schedules indicated the individual farmers (1) present yield, (2) present normal cropping pattern, and (3) anticipated future land use and yields if adequate drainage outlets were provided and a ten year level of flood protection assured.

Information on crop production practices and cost of production and operations was also obtained. This information, in addition to the data on cropping patterns and yields, was evaluated for accuracy and reasonableness by agricultural agency personnel working in the area.

The without project use of cropland and yields in the problem area is as follows:

<u>CROP</u>	<u>PERCENT OF</u> <u>CROPLAND USE</u>	<u>YIELDS PER ACRE</u>
Corn - Grain	20.4	52 Bu.
Corn - Silage	13.6	10 Tons
Snap Beans (Processing)	9.6	1.5 Tons
Wheat	8.5	33 Bu.
Oats	8.5	45 Bu.
Cl.-Mix. Hay	11.0	1.7 Tons
Alf.-Hay	28.4	1.9 Tons

1. The first part of the report deals with the general situation of the economy in the United States. It is a very good summary of the current situation and the trends of the economy.

Item	1950	1951	1952
GDP	100.0	100.0	100.0
Personal Income	100.0	100.0	100.0
Government Expenditure	100.0	100.0	100.0
Private Expenditure	100.0	100.0	100.0
Total Expenditure	100.0	100.0	100.0

Item	1950	1951	1952
Government Expenditure	100.0	100.0	100.0
Private Expenditure	100.0	100.0	100.0
Total Expenditure	100.0	100.0	100.0
Government Revenue	100.0	100.0	100.0
Private Revenue	100.0	100.0	100.0
Total Revenue	100.0	100.0	100.0

2. The second part of the report deals with the specific situation of the economy in the United States. It is a very good summary of the current situation and the trends of the economy.

3. The third part of the report deals with the specific situation of the economy in the United States. It is a very good summary of the current situation and the trends of the economy.

4. The fourth part of the report deals with the specific situation of the economy in the United States. It is a very good summary of the current situation and the trends of the economy.

Item	1950	1951	1952
Government Expenditure	100.0	100.0	100.0
Private Expenditure	100.0	100.0	100.0
Total Expenditure	100.0	100.0	100.0
Government Revenue	100.0	100.0	100.0
Private Revenue	100.0	100.0	100.0
Total Revenue	100.0	100.0	100.0

Project benefits were based on increases in average yields expected "with" as compared to "without" project, including consideration due to the present and future flooding. The resulting joint benefits were then allocated to each purpose in the same proportion as costs were to purpose. In this manner it was determined that 54.1% of the channel and appurtenance costs and benefits should be allocated to drainage and 45.9% to flood prevention.

More intensive land use benefits were computed on present cropland acres only. They were based on future net income with flood protection at the ten year level less associated costs as compared to present net income. In this manner more intensive land use benefits of \$5,295 (flood prevention) and \$6,241 (agricultural water management (drainage)) were determined from 1,022 acres of cropland and pasture. Total benefits of \$11,536.

From farm interviews checked with professional agricultural agency personnel working in the area and with the Mason County Soil Conservation District Directors, it was determined that farmers in the problem area would plan for a changed land use of 24 acres of pasture and 47 acres of woods to cropland. Benefits accruing as a result of the conversion of these acres to cropland were determined by (1) estimating the expected future distribution of crops on this acreage, (2) calculating the expected future net income on this acreage, and (3) deducting all associated costs. Benefits of this type were estimated at \$1,616 of which \$742 is a flood prevention benefit and \$874 is an agricultural water management (drainage) benefit.

Future floodwater damages in the floodplain "with project" as a result of increased yields, cropping pattern and land use adjustments were estimated to be \$248 annually. Dollar damage values per acre determined in similar watersheds were used, together with an estimate of the total acres flooded by a 50 year frequency storm "with project".

The calculation of annual costs and benefits are based on the assumption that 100% of the needed tributary outlet improvements and 30% of the needed on-farm drainage program will be completed during project installation, an additional 25% of the on-farm drainage will be completed in the first five year period following project installation and 20% will be installed in the period 5-15 years following project installation.

The "with project" land use pattern was estimated as follows:

<u>LAND USE</u>	<u>ACRES</u>	<u>PERCENT</u>
Cropland	1,093	85.0
Pasture	24	1.9
Woods (incl. Brush)	109	8.4
Idle & Miscellaneous	60	4.7
TOTAL	1,286	100.0

The "with project" use of cropland and anticipated yields per acre with adequate drainage were determined to be as follows:

<u>CROP</u>	<u>PERCENT OF CROPLAND USE</u>	<u>AVERAGE YIELDS PER ACRE</u>
Corn - Grain	20.3	73 Bu.
Corn - Silage	13.5	14.5 Tons
Snap Beans (Processing)	9.6	3.0 Tons
Wheat	8.5	46 Bu.
Oats	8.5	75 Bu.
Cl.-Mix. Hay	11.2	3.1 Tons
Alf.-Hay	28.4	3.6 Tons

Economic studies were made in order to determine the economic feasibility of each separate tributary (the main channel, Tuttle Drain, Falconer Drain, and New Drain). Results show all increments to be economically justifiable with benefit cost ratios ranging from 1.2:1.0 to 4.4:1.0.

Cost Allocation

The following costs for channel improvement have been allocated to flood prevention and agricultural water management (drainage) purposes by the method as outlined under Section 1, Cost Allocation, page 9.

The use of this formula resulted in the following cost allocations for the multiple purpose channel:

$$\frac{\$83,472}{\$83,472 + \$70,890} \times \$94,956 = \$51,371 \quad \text{Drainage 54.1\%}$$
$$\$94,956 - \$51,371 = \$43,585 \quad \text{Flood Prevention 45.9\%}$$

Unit prices used in all benefit determinations in this work plan were obtained locally by interview with elevator operators, contractors, farmers, and agricultural agency personnel. Throughout this report 1961 prices were used as a base projected to long term prices for evaluating benefits. In calculating the cost of construction, the estimated prices were based on 1962 costs for materials in place. Operation and maintenance costs were converted to projected long term prices.

For converting public and private investments to annual bases and in amortizing and discounting costs and benefits the following interest rates were used:

- A. 3% for converting all installation costs to average annual costs over a 50-year period.
- B. 6% for converting local associated on-farm costs to an annual basis.
- C. 5% for converting local associated costs on public tributary drains to an annual basis.
- D. 3% for discounting of agricultural water management benefits to reflect the anticipated lag in accrual of such benefits.

1. The first part of the document is a list of names and addresses, which are arranged in a table-like format. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list includes names such as "John Smith", "Mary Jones", and "Robert Brown", along with their respective addresses in various cities and states.

2. The second part of the document is a list of names and addresses, which are arranged in a table-like format. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list includes names such as "John Smith", "Mary Jones", and "Robert Brown", along with their respective addresses in various cities and states.

3. The third part of the document is a list of names and addresses, which are arranged in a table-like format. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list includes names such as "John Smith", "Mary Jones", and "Robert Brown", along with their respective addresses in various cities and states.

4. The fourth part of the document is a list of names and addresses, which are arranged in a table-like format. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list includes names such as "John Smith", "Mary Jones", and "Robert Brown", along with their respective addresses in various cities and states.

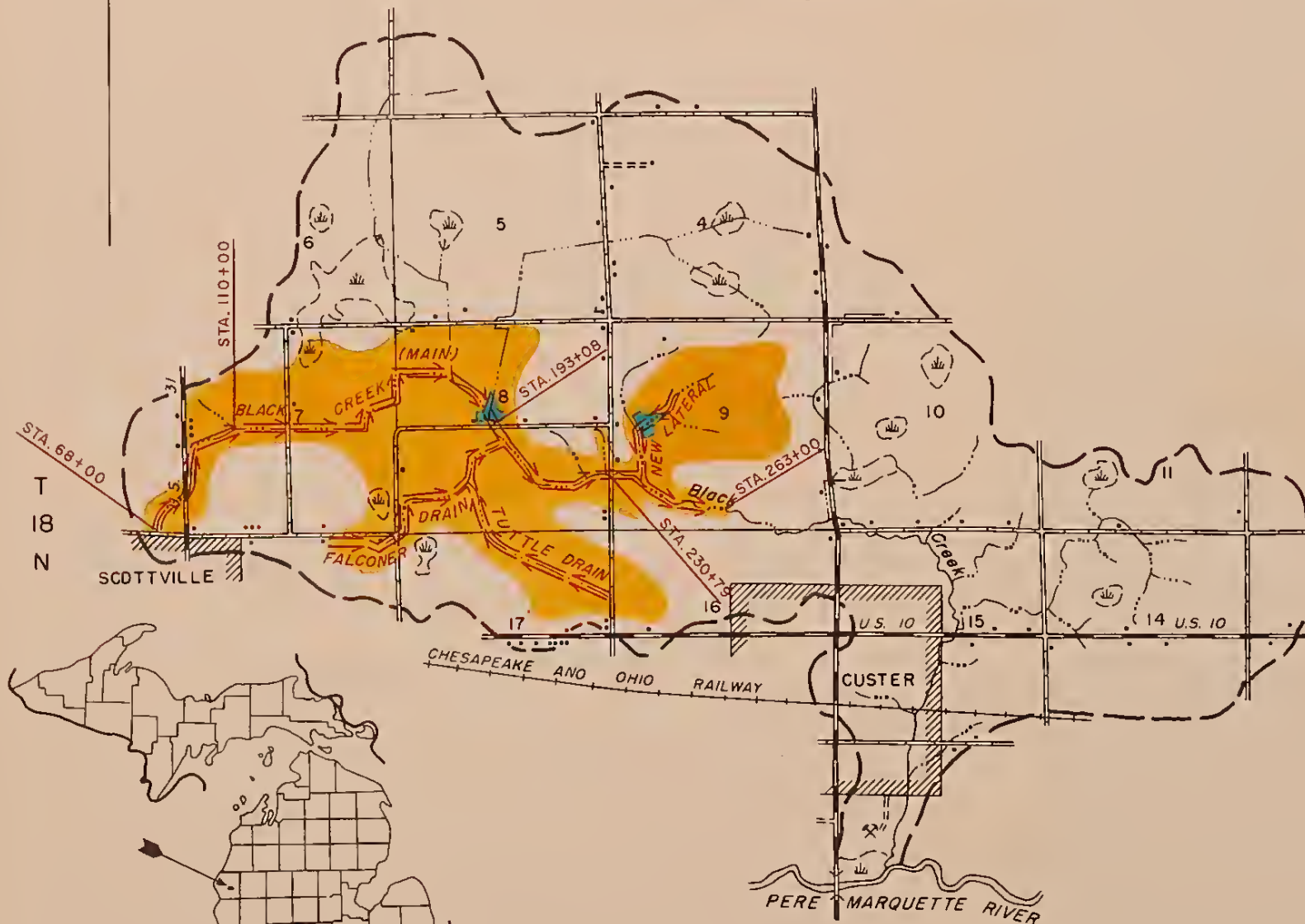
5. The fifth part of the document is a list of names and addresses, which are arranged in a table-like format. The names are written in a cursive script, and the addresses are written in a more formal, printed style. The list includes names such as "John Smith", "Mary Jones", and "Robert Brown", along with their respective addresses in various cities and states.

PROJECT MAP

BLACK CREEK - MASON WATERSHED

MASON COUNTY, MICHIGAN

R 16 W



LOCATION IN MICHIGAN

LEGEND

SECTION LINE	---
SECTION NUMBER	22
PAVED ROAD	==
GRAVEL ROAD	- - - -
DIRT ROAD	---
FARM ROAD	---
RAILROAD	+
CROSSING (GRADE)	+
BRIDGE, ROAD	+
HOUSE	•
SCHDDL	•
CITY	■
PERENNIAL STREAM, LARGE	~~~~~
PERENNIAL STREAM, SMALL	~~~~~
INTERMITTENT STREAM	---
SWAMP	+
GRAVEL PIT, QUARRY OR MINE	+
WATERSHED BOUNDARY	---
MULTIPLE PURPOSE CHANNEL IMPROVEMENT (F.P. & AG. WATER MGT.)	==>
AREA BENEFITED BY FLOOD PREVENTION & DRAINAGE	■
GRADE STABILIZATION STRUCTURE	▲

Figure 1

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